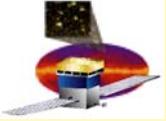


First International GLAST Symposium Summary

Roger Blandford
KIPAC
Stanford



Some Questions

- What can you do with so few photons?
- Why should I devote my precious observatory time to your future satellite? (Come back after its launched, if it works!)
- What's new?
- What will be ν ?
- Where's the physics?
- Why are you doing this?
- Who will win a Nobel prize?

GLAST

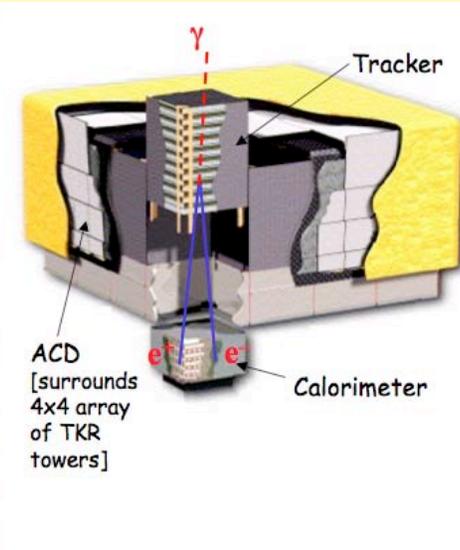
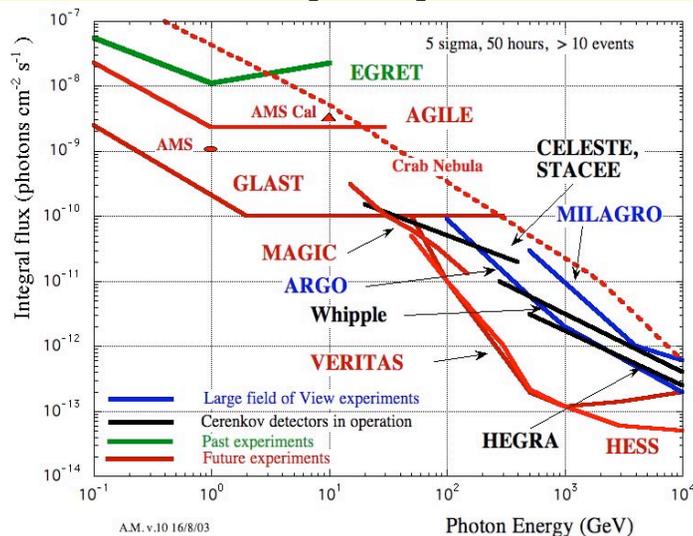
LAT

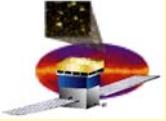
- 0.02 - 300 GeV, ~0.1 energy resolution
- 2.5 sr, 10,000 cm²
- 5° - 5' resolution
- 3 x 10⁻⁹ cm⁻² s⁻¹ (>0.1 GeV, point source)
- 10,000 sources mostly blazars+unidentified
- 10⁹ photons
- Negligible deadtime
- Cover sky every 3hr

GBM

- 0.01-30 MeV, ~ 0.1 energy resolution
- 9sr
- degree resolution
- All sky

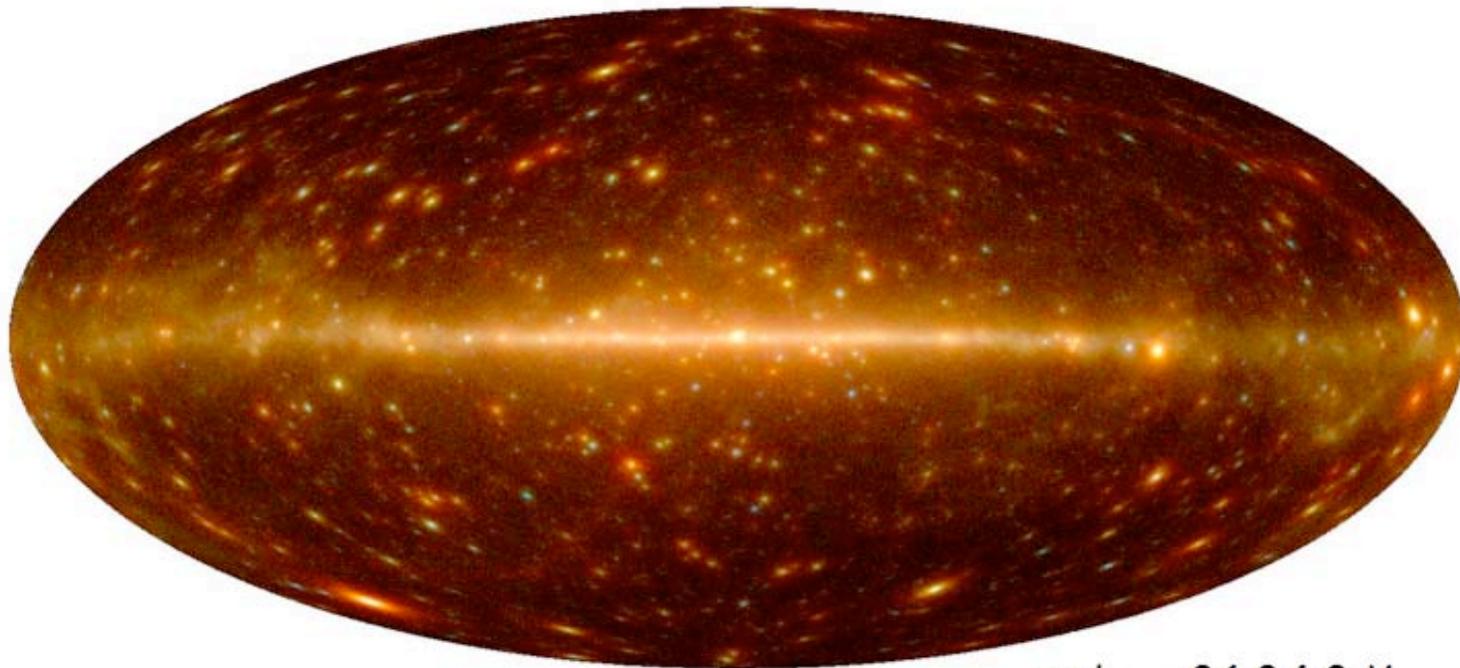
Meegan



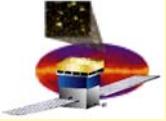


Data and Service Challenges

- Great progress handling simulated data, testing pipelines etc
- Integration with Science Working Groups
- Do we need Science Challenges?
- **The Making of Lists** *Fosatti, Torres, Ubertini*
 - 10,000 blazars, 100 pulsars 50/200 GRB/yr(LAT/GBM), 50 SNR/PWN, 10 HMXB....
 - Unidentified?

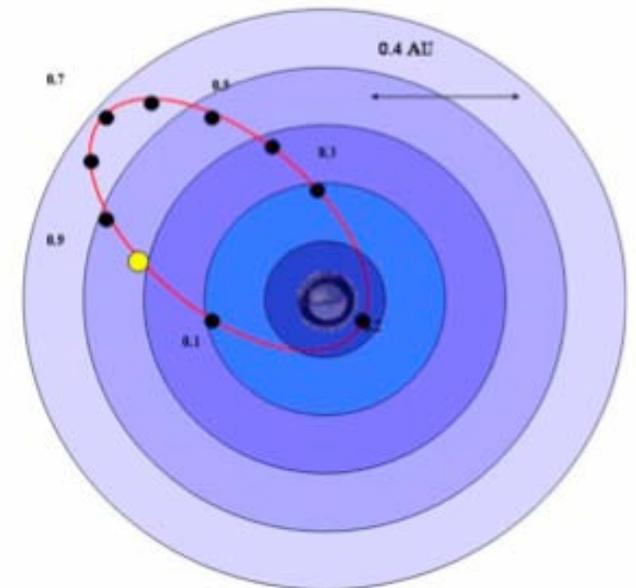
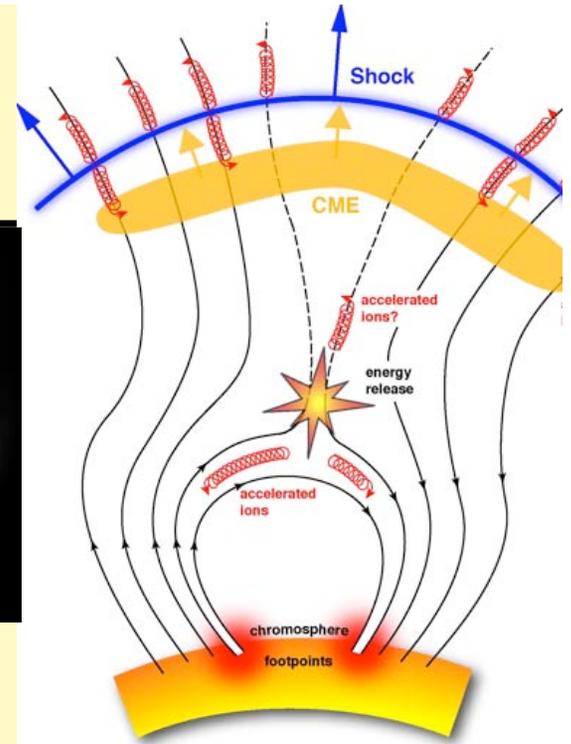
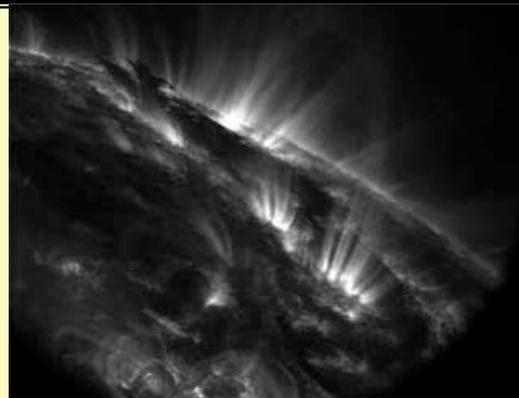


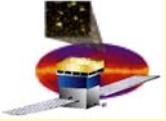
red: 0.1-0.4 GeV
green: 0.4-1.6 GeV
blue: >1.6 GeV



Stars

- **Sun** *Share*
 - Flares
 - Solar minimum->maximum
 - Observe neutrons
 - Radiation hazard
 - *Minutes!*
- **3 HMXB** *Dubus
Cortina
Hermsen*
 - LSI+61 303
 - *NS-Be*
 - *P=27d*
 - *e ~ 0.7*
 - *i ~ 60°*
 - PWN orbiting Be excretion disk?





Jet Physics

- **Blazar**

- AGN classification
- Blazar sequence (10^{-4} of galaxies)
 - *FR2->FR1?*
 - *GLAST observe more RG*
- Variability *Wagner*
 - *M87*
 - *Mk 501* *Mazin*
 - *Contrary evolutions* *Fukazawa*

- **GRB**

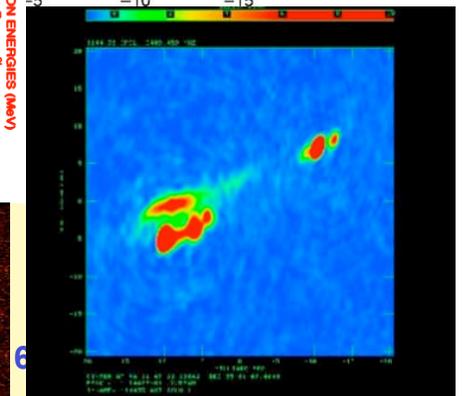
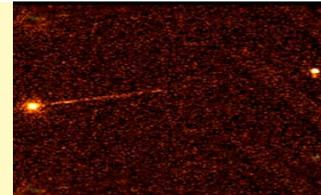
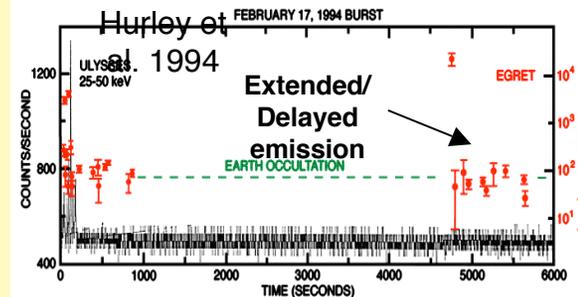
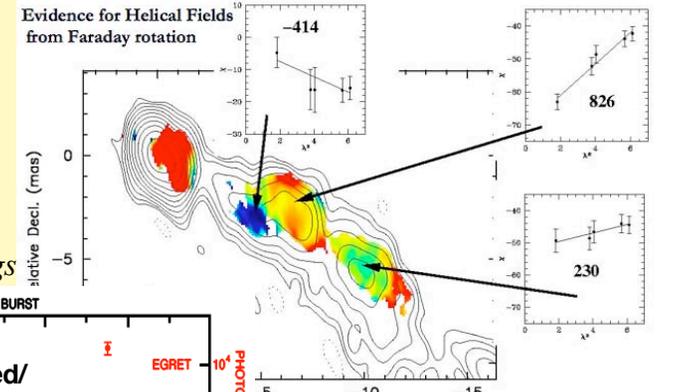
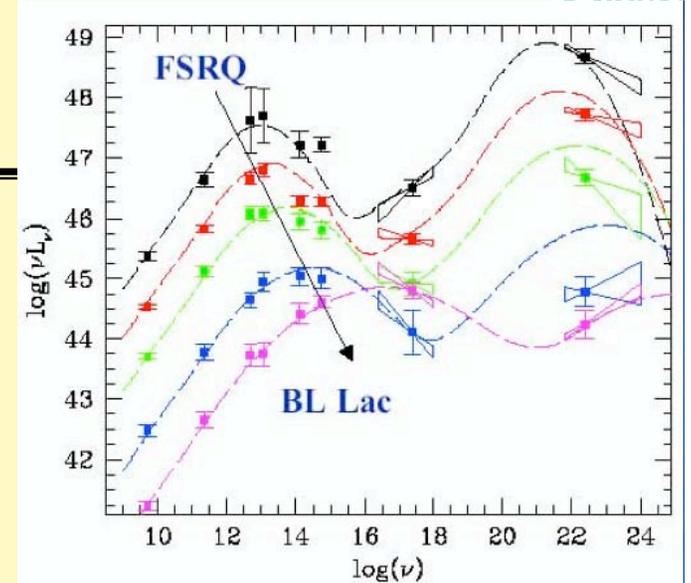
Ptran, Granot

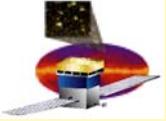
- Long - collapsars; short- NS coalescence??
- Late emission, plateau, chromatic breaks *Butler Briggs*
- Faster than Blazar jets

- **Jet Physics**

Taylor

- Emission mechanism
- SSC vs EC
- Opacity, location *Baring*
- Bulk Comptonization and Cooling
- Composition, Structure, Confinement
- Impact





Pulsar Physics

Harding

• Detection

- 100s pulsars?
- 50 RQ pulsars?
- 10 MSP
- RRATS
- Blind searches

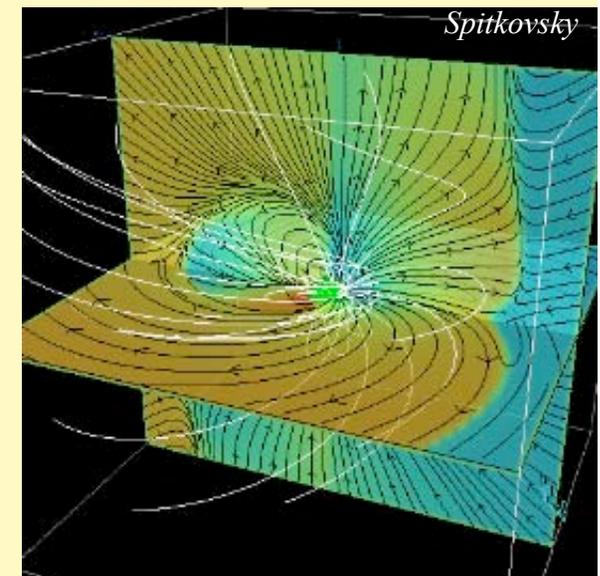
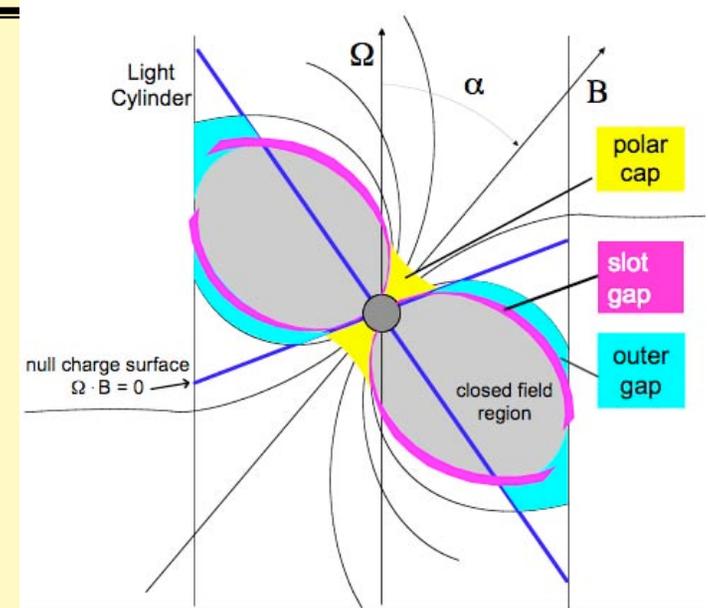
*Johnston
Ransom*

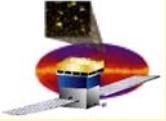
• How do pulsars shine?

- Polar cap vs slot gaps vs outer gaps
- Locate gamma ray and radio emission
- Does gamma ray power $\sim V$?

• Force free models

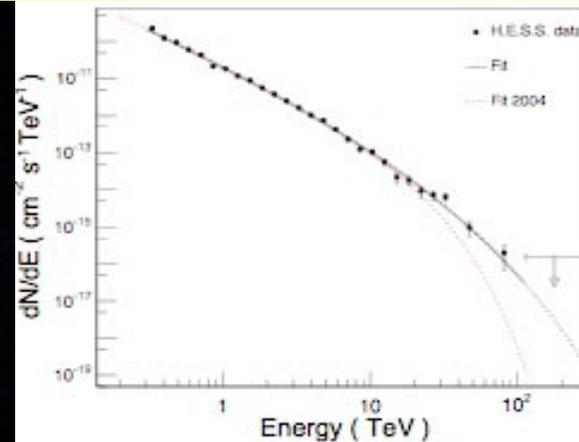
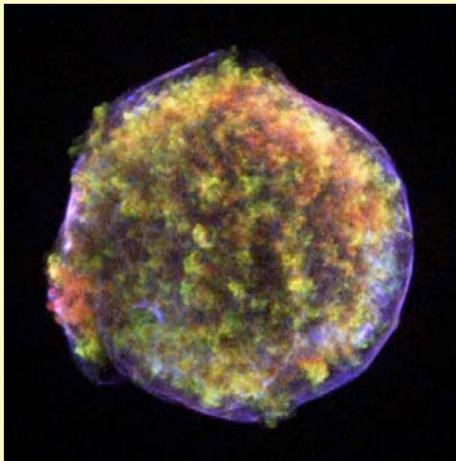
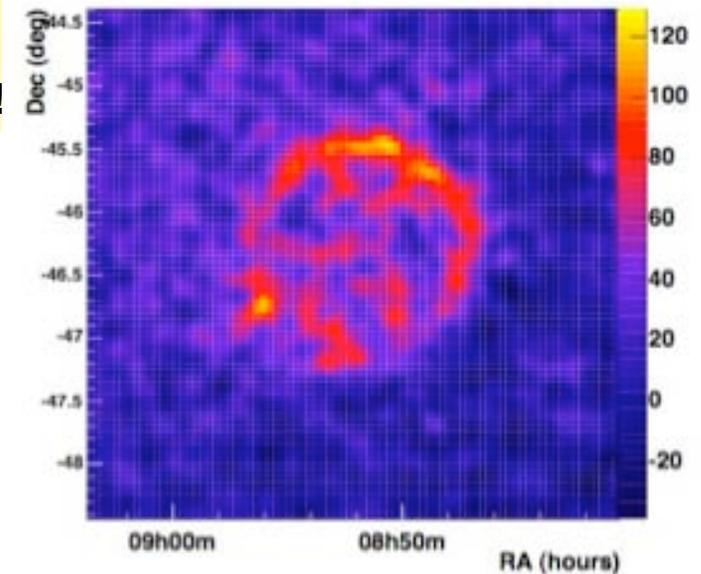
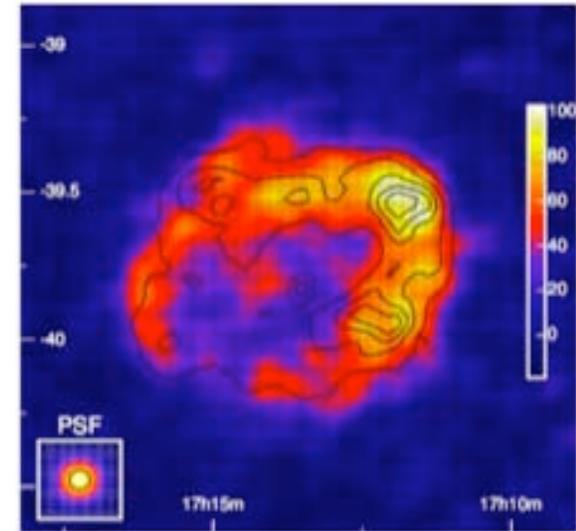
- Compute pulse profiles for different emission sites and fit to radio, gamma ray observations
- Is the rotating vector model really supported by observations?
 - *Orthogonal polarization!*

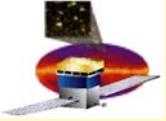




Supernova Remnants

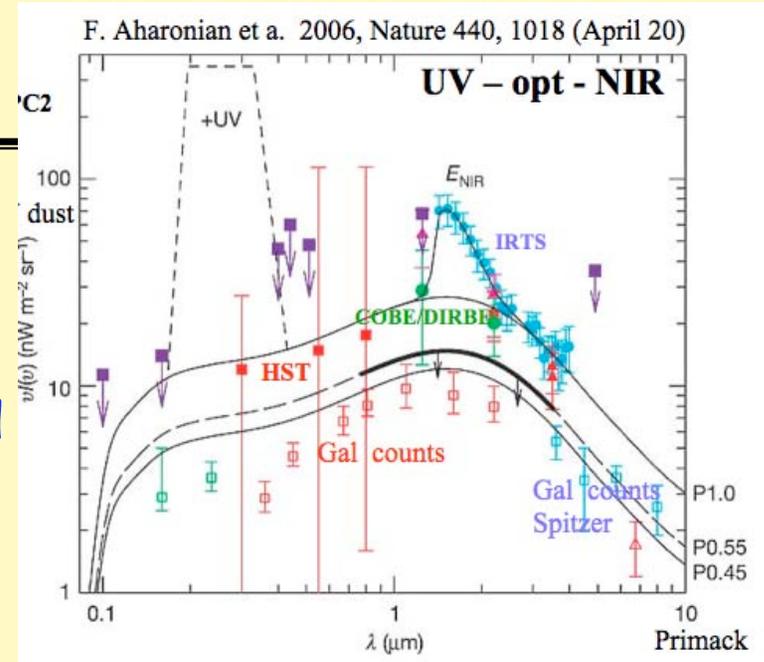
- **Nonthermal accelerators** *Drury*
 - >100TeV
 - Spectral curvature
- **Hadronic vs leptonic**
 - n problem or B problem?
 - GLAST should decide
 - Local FIR not CMB?
- **Acceleration** *Slane*
 - PeV-> mG *Blandford*
 - DSA vs F2 vs ?
 - If DSA do not need scattering behind shock!





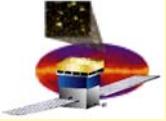
Backgrounds

- **Interplanetary**
 - C⁻¹ starlight
- **Diffuse interstellar**
 - GeV excess? Cygnus TeV? *Digel, Knodelseder, Abdo*
- **Extragalactic gamma ray background**
 - Sum of sources or new component? *Dermer*
- **Extragalactic X-ray background**
 - INTEGRAL reports HEAO-1 spectrum x 1.1
- **Extragalactic stellar background**
 - TeV observations vs Spitzer - limits on Pop III contribution?
 - GLAST will see to greater distance and study evolution
- **Extragalactic cosmic ray background**
 - AGN vs GRB
 - Hard for UHECR to escape either environment
- **Dark matter annihilation background**
 - Lines?
 - *No “no go” theorem*
 - Bump
 - *Validation of DM signal will be a challenge*
 - *Confusion with PWN etc?*



Hartmann

Kuhlen, Wai, Koushiappas



The Multiwavelength Challenge

Thompson

- **Blazars - radio catalog,**
 - Suzaku, Spitzer, Swift, LMT...
- **Pulsars - timing models**
- **GRBs - Swift**
 - 10yr, 0.25 overlap
- **Suzaku, LMT**
- **IDs**
 - Figure of merit
 - Variability
 - Statistical
- **Discover new sources!!**

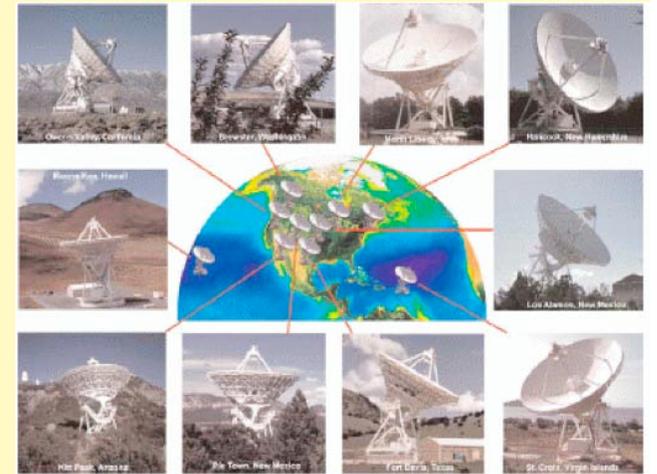
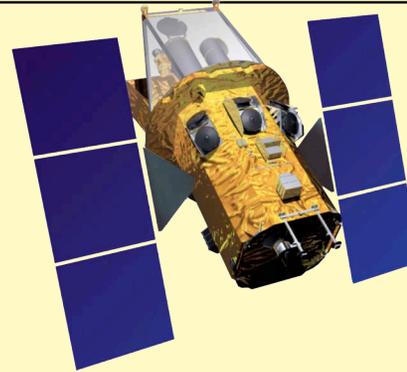
Giommi

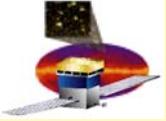
Thorsett

Gehrels

Kataoka

Carraminana





Summary

- GLAST links great discoveries of X-ray astronomy to tremendous advances in TeV range
- Poised to address fundamental high energy astrophysics questions through observing AGN, GRB, PSR, PWN, SNR...
- Physical processes are generic - laboratories to study emission mechanisms, RMHD, relativistic plasmas, particle acceleration, transport processes
- Investigations are mostly multi-wavelength over whole 70 octave EM spectrum (+ ν , CR, GW)
- Much work - instrumental, computational, observational and theoretical - needs to be done prior to launch